

BRITISH STANDARD

Wall and floor tiling –

Part 2: Design and installation of external ceramic and mosaic wall tiling in normal conditions – Code of practice

ICS 91.060.10; 91.060.30



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Foreword

Publishing information

This part of BS 5385 was published by BSI and came into effect on 29 September 2006. It was prepared by Technical Committee B/539, *Ceramic tiles and other rigid tiling*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This part of BS 5385 supersedes BS 5385-2:1991, which is withdrawn.

Relationship with other publications

This part of BS 5385 is one of a series dealing with the installation of floor and wall tiling the other parts being:

- *Part 1: Design and installation of ceramic natural stone and mosaic wall tiling in normal internal conditions – Code of practice*
- *Part 3: Design and installation of internal and external ceramic and mosaic floor tiling in normal conditions – Code of practice*
- *Part 4: Design and installation of ceramic and mosaic tiling in special conditions – Code of practice*
- *Part 5: Design and installation of terrazzo, natural stone, agglomerated stone tile and slab flooring – Code of practice*

Information about this document

This is a full revision of the standard, and introduces the following principal changes:

The code now recommends that only adhesives are used for bedding external tiling, although cement:sand mortar remains an alternative for bedding mosaics and some key-backed extruded tile. Illustrations of movement joints have been included, the tables for sealants and backgrounds have been revised and a cleaning and maintenance section has been added.

Assessed capability. Users of this British Standard are advised to consider the desirability of quality system assessment and registration against the appropriate standard in the BS EN ISO 9000 series by an accredited third-party certification body.

Use of this document

As a code of practice, this part of BS 5385 takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this part of BS 5385 is expected to be able to justify any course of action that deviates from its recommendations.

Attention is drawn to the following statutory regulations:

- *Building and Construction Regulations under the Factories Act [1]*
- *Lifting Operations and Lifting Equipment Regulations [2]*
- *Manual Handling Operations Regulations [3]*

Presentational conventions

The provisions in this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

1 Scope

This part of BS 5385 gives recommendations for the design and installation of external ceramic and mosaic wall tiles in normal climatic conditions in the UK. It deals with the types of backgrounds and their suitability to receive tiling using the following fixing methods:

- a) bedding in cementitious or organic adhesives on an intermediate substrate or as a direct bedding method;
- b) bedding mosaics in cement:sand mortar on rendering or as a direct bedding method.

NOTE Cement:sand mortar is seldom used as the bed for external wall tiling but, if needed, see BS 5385-1.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 410 (all parts), *Test sieves*

BS 915-2, *Specification for high alumina cement – Part 2: Metric units*

BS 1210, *Specification for wood screws*

BS 4027, *Specification for sulfate-resisting Portland cement*

BS 4483, *Steel fabric for the reinforcement of concrete – Specification*

BS 4551, *Mortar – Methods of test for mortar – Chemical analysis and physical testing*

BS 5262, *Code of practice for external renderings*

BS 5974, *Code of practice for temporarily installed suspended scaffolds and access equipment*

BS 6100-1.3.1, *Glossary of building and civil engineering terms – Part 1: General and miscellaneous – Section 1.3 Parts of construction works – Subsection 1.3.1 Walls and cladding*

BS 6213, *Selection of construction sealants – Guide*

BS 8000-11.1, *Workmanship on building sites – Part 11: Code of practice for wall and floor tiling – Section 11.1: Ceramic tiles, terrazzo tiles and mosaics*

BS EN 197-1, *Cement – Part 1: Composition, specifications and conformity criteria for common cements*

BS EN 12004:2001, *Adhesives for tiles – Definitions and specifications*

BS EN 13139:2002, *Aggregates for mortar*

BS EN 13888:2002, *Grouts for tiles – Definitions and specifications*

BS EN 14411, *Ceramic tiles – Definitions, classification, characteristics and marking*

BS EN ISO 10545-12, *Ceramic tiles – Part 12: Determination of frost resistance*

3 Terms and definitions

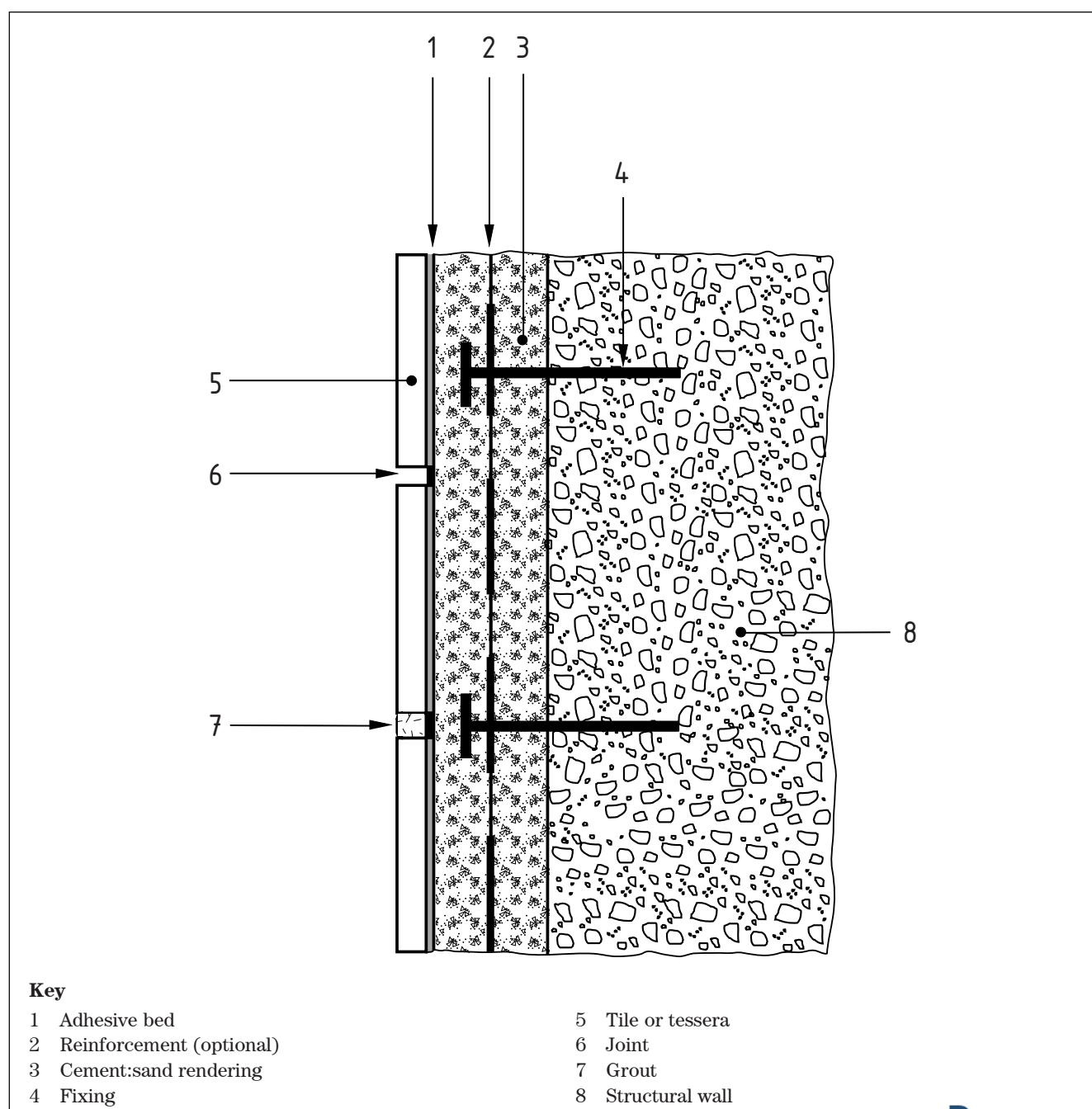
NOTE An illustration of some selected definitions is shown in Figure 1.

For the purposes of this part of BS 5385 the terms and definitions given in BS 6100-1.3.1, BS EN 14411 and the following apply.

3.1 bond breaker tape

self-adhesive tape, usually polyethylene or polytetrafluoroethylene (PTFE) used to prevent sealant sticking to a substrate

Figure 1 Illustration of selected definitions



4 Exchange of information and time schedule

NOTE Clause 4 deals with the exchange of information for the whole wall, including tiles, tile bed, background and intermediate substrate, (if any).

4.1 Exchange of information

The working drawings and specifications should be prepared in sufficient detail to afford proper guidance in the design and execution of the work. At the tendering stage the following information should be sought and documented:

- a) *Site*. Location and means of access.
- b) *Building*. Nature of building and particulars of corrosive or other potentially damaging conditions to which the installation might be subjected in service (e.g. mechanical cleaning).
- c) *Wall(s)*. Type and age of construction, location, height, type and accuracy of backgrounds and need for intermediate substrate or special mechanical fixing systems (see 6.5).

NOTE Permissible deviations from horizontal and perpendicular lines in building construction are usually greater than appropriate for ceramic tiling or mosaic finishes.

- d) *Associated work*. Elements embedded in or passing through the wall, skirtings and abutments, junctions with other adjacent finishes.
- e) *Finishes*. Type(s) of tiles and/or mosaics, bedding and jointing requirements and required surface plane.
- f) *Contract*. Details, if the work is to be completed in any specific order or in sections.
- g) *Health and safety*. Information on articles and substances for use during the work that is liable to be a health risk.
- h) *Time schedule*. A time schedule for the progress of the work (see 4.3).
- i) *Testing*. Details of any compliance testing needed.

4.2 Provision of utilities, facilities and materials

To prevent misunderstanding, particularly at the tendering stage, and to avoid possible situations detrimental to installation, it should be made clear whether or not the following is provided and by whom:

- a) adequate clean, dry, lockable storage space protected from frost (if necessary) (see 5.1);
- b) clean water supply adjacent to working areas (see 5.6);
- c) adequate artificial lighting (if necessary), e.g. for tiling within a protected enclosure;
- d) safe means of access and places of work, to include, where necessary, suitable scaffolding and staging, which should conform to BS 5974;

NOTE 1 Attention is drawn to the requirements of the Building and Construction Regulations under the Factories Act [1].

- e) unloading and hoisting facilities;

NOTE 2 The following references are valid: Lifting Operations and Lifting Equipment Regulations [2], Manual Handling Operations Regulations [3].

- f) electric power supply adjacent to working areas;
- g) protection of work during and after fixing (see **6.3**);
- h) supplies of cement and sand in accordance with **5.4** and **5.5**;
- i) tiles, adhesives, grouts, primers and sealants.

A check should be made to ensure that all materials needed for the installation are available.

4.3 Time schedule

The time schedule for the whole building work should be planned in the initial stages before operations commence and, where possible, in consultation with those responsible for carrying out the work of each of the trades concerned.

In preparing the time schedule, each operation should be considered in relation to others. Due consideration should be given to the most economical use of general plant and scaffolding by all trades, also to ensure that the various trades do not interfere unduly with each other's work.

For economic and efficient application of external tiling and mosaics, work should begin at the highest point of the construction. In addition, in certain forms of a multi-storey construction, some deflection of the wall can occur at lower levels as the construction increases in height and the loading consequently increases. It is important, therefore, that application of tile or mosaic cladding should not commence until the construction has been erected to its full height.

At least six weeks should be allowed in the time schedule for the drying out and initial shrinkage of the structural or non-structural concrete. If an intermediate substrate e.g. rendering is subsequently applied, each coat should be cured, allowed to dry and harden in accordance with BS 5262 to permit drying shrinkage before the final coat is applied. The final coat should be cured and left to dry for at least a further two weeks. The drying times of all in situ backgrounds are the minimum required under optimum conditions and these drying times should be considerably extended under adverse drying conditions on site, e.g. low temperatures and wet conditions.

The schedule should allow sufficient time for the cutting of holes and chases and/or other work involving the use of percussion tools in or on the walls to receive a bedded finish, and adjacent walls, to be completed before a substrate is applied. All the time allowances mentioned are equally applicable where a substrate is to be omitted and the tile or mosaic finish bedded directly to the structural background.

The schedule should provide for the completion of all necessary subsidiary work before the fixing of tiles or mosaics begins. The schedule should include times for commencement and completion of tiling or mosaic work to the different parts of the construction, allowing sufficient time intervals between the operation of the bedding, grouting and final cleaning down.

Provision should be made for adjustment to allow for suspension of operations due to frost or other unfavourable weather or other conditions that jeopardize the safety of workers and/or the success of the installation.

Alternatively, consideration should be given to the possibility of providing a protective enclosure, e.g. cocooning, to enable work to continue during unfavourable conditions. In addition, heating might be necessary.

5 Materials

5.1 Transport and storage

The delivery of materials should be arranged to minimize handling. Adequate precautions should be taken to guard against the possibility of damage.

Materials should be stored in clean, dry, frost-free (if necessary), lockable storage to avoid excessive handling, theft and damage.

5.2 Ceramic tiles

NOTE Informative Annex A contains information about ceramic tiles

Ceramic tiles for external use at above first floor height should be Class BI_a (see Table 1). The tile surface should not be larger in facial surface area than 0.1 m² unless secured by mechanical means (see 6.5).

Ceramic tiles for external use up to first floor height should have water absorption of not more than 3% and should either be extruded tiles type AI or dust-pressed tiles types BI_a and BI_b (see Table 1 and 6.3).

Before selecting a particular type of tile, advice about its suitability should be obtained from the supplier.

Table 1 **Classification of ceramic tiles with respect to water absorption (E) and shaping**

Shaping	A Extruded	B Dry pressed
Group I E ≤ 3%	Group AI	Group BI _a E ≤ 0.5% Group BI _b 0.5% < E ≤ 3%

NOTE See BS EN 14411:2003, Table 1 for water absorption limits for Groups II and III tiles which are of higher water absorption and therefore unsuitable for external use.

5.3 Mosaics

NOTE Informative Annex A contains information about mosaics

For a mosaic that has been assembled with a backing material, it is essential that:

- the backing material and its adhesive does not occupy more than 25% of the area of each tessera; the critical factor is the spread of the adhesive over the backs of the tesserae;
- the backing material and its adhesive does not deteriorate in service and that they are compatible with the mortar or adhesive bed in accordance with manufacturer's instructions.

When sheets of mosaic are assembled using backing material it should be made of synthetic fabric, not of natural fabric such as cotton; or paper as this becomes embedded in the mortar or adhesive.

Ceramic tesserae should conform to the relevant physical and chemical properties given in BS EN 14411.

For mosaics that are to be fixed in locations liable to frost, ceramic tesserae should pass the frost resistance test as described in BS EN ISO 10545-12.

Before selecting a particular type of mosaic, advice about its suitability should be obtained from the supplier.

5.4 Cement

The cement for cement:sand mortar beds to be used for bedding mosaics and key-backed extruded tiles should be one of the following:

- a) Portland cement (CEM I) conforming to BS EN 197-1;
- b) Sulfate-resisting cement conforming to BS 4027;
- c) Calcium aluminate cement (high alumina cement) conforming to BS 915-2.

WARNING Cement of all types should be used with care, because of the possible risk of adverse skin effects. Suppliers' material safety data sheets obtained at the exchange of information stage described in 4.1g) should be used as a basis for assessing and managing the risk associated with its use in a particular application.

Cement should be stored under dry conditions and used in order of delivery. Cement that contains air set lumps should not be used.

5.5 Sand

5.5.1 General

All stocks of sand should be protected from rain, frost and any form of contamination.

5.5.2 Sand for cement:sand rendering and mortar beds for mosaics

NOTE For guidance see the first entry under "Plastering or rendering" in PD 6682-3:2003 Table A1.

Sand conforming to BS EN 13139:2002 recommended European designation 0/2 (CP or MP), Category 2 fines, is recommended for cement:sand rendering and mortar beds for mosaics.

5.5.3 Sand for grout mortars mixed on site

5.5.3.1 For joints of nominal widths 6 mm and above

NOTE For guidance see the second entry under "Plastering or rendering" in PD 6682-3:2003, Table A1.

Sand conforming to the grading limits of BS EN 13139:2002 recommended European designation 0/2 (FP or MP), Category 2 fines, is suggested for grouting joints 6 mm or more in width.

5.5.3.2 For joints less than 6 mm wide

Sand for grouting joints less than 6 mm wide should conform to the grading limits given in Table 2.

Sands conforming to BS EN 13139:2002 recommended European designation 0/2 (FP or MP), Category 3 fines might be suitable, but the fraction greater than 2.36 mm should be screened off.

NOTE For guidance see the second entry under "Masonry" in PD 6682-3:2003, Table A1.

For narrow joints below 3 mm finer grading should be used.

Table 2 Sand for grouts for joints less than 6 mm wide

BS 410 sieve (mm)	% by mass passing BS 410 sieves
2.36	100
1.18	95 – 100
600	80 – 100
300	30 – 100
150	0 – 60
75	Not greater than 7

5.6 Water

Water should be clean and free of materials deleterious to mortar beds in their fresh and hardened states (see BS EN 1008). Drinking water is suitable. All containers used for storing or carrying water should be clean.

5.7 Adhesives

5.7.1 General

Cementitious adhesives (C) and reaction resin adhesives (R) should conform to BS EN 12004.

5.7.2 Admixtures to adhesives

An aqueous polymer dispersion can be incorporated in cement based adhesives to obtain greater adhesion, improved resilience or some reduction in water permeability. Such admixtures should be used only with adhesives approved by the manufacturer. The use of admixtures is not necessary when adhesives with additional characteristics such as those given in BS EN 12004:2001 under Type C Class are used.

Admixtures should be used strictly in accordance with the manufacturer's instructions and should not be added to an adhesive unless approved by the manufacturer of the adhesive.

NOTE Bonding agents are available to improve the adhesion of renderings and/or tile beds to backgrounds.

5.8 Bonding agents

Bonding agents are usually mixed with cement and sand, or more commonly with neat cement, and should be applied as a wet slurry or stipple immediately prior to the application of the mortar. For optimum results the bonding agent should also be used as an admixture in the mortar. This gives improved compressive and tensile strength, allowing mortars to be applied in thinner sections, thus reducing the weight of the construction.

Bonding agents based on polyvinyl acetate or any other polymer affected by moisture should not be used in external applications.

The manufacturer's recommendations for the particular type of bonding agent to be used and its method of application should always be strictly followed.

5.9 Sealants and back-up materials for movement joints

5.9.1 General

Materials for movement joints should be non-rigid; they should combine the properties of resilience and/or plasticity within the maximum temperature ranges likely to be encountered and should be resistant to mould growth.

5.9.2 Sealants

Joint sealants should be selected and applied in accordance with the guidance given in BS 6213.

Sealant manufacturers' advice should be taken into account as the properties of individual sealants can vary. Generally, a sealant should be capable of accommodating the anticipated amount of movement without loss of adhesion to the sides of the joints and be able to withstand the normal service conditions affecting the installation, e.g. resistant to water, ultraviolet light.

Where movement is large and frequent, Class 25 sealants should be used. For joints undergoing smaller and less frequent, movement Classes 20 or 12.5 can be considered however where the class number is less than 20 the sealant might not be suitable over structural movement joints. For a given extent of movement, the narrower the joint, the higher the sealant class needed to accommodate the movement.

NOTE Information on sealant installation is given in 10.4.

5.9.3 Back-up materials

The compressible back-up material should be a material to which the sealant does not adhere, or one which can be covered with a bond breaker tape to prevent adhesion.

The back-up material in the lower part of the joint should be compatible with the sealant used, should recover after compression and should support the sealant. It should not exude bituminous or oily products and should not absorb excessive amounts of moisture. In particular, its compressibility should be such that when the joint closes the sealant is not forced out. Suitable materials include closed cell cellular rubber and plastics, such as cellular polyethylene, some fibre building boards, cork boards and mineral or synthetic ceramic cords or blankets. Back-up materials are available in sheet strip and cord form in a range of sizes.

NOTE Information on back-up material installation is given in 10.5.

5.10 Grouts

5.10.1 General

Grouts should have good working characteristics, low shrinkage and good adhesion to the sides of the tiles, whilst being capable of being cleaned off the face of the tiles without undue difficulty. When selecting a grout the specifier should establish that it is suitable for exposure to external conditions.

5.10.2 Types of grout

5.10.2.1 Proprietary grouts

Proprietary grouts should conform to BS EN 13888:2002, Type CG or RG and should be one of the following types:

- a) mixes based on cement and mineral fillers but modified by the inclusion of various additives, including pigments and organic additives, that only require to be mixed with clean water to the recommended consistency (CG);
- b) mixes based on cement and mineral fillers and additives to be mixed with aqueous synthetic polymer dispersions to the recommended consistency (CG);
- c) mixes based on epoxide resin consisting of separate pre-gauged components to be mixed together immediately before use (RG).

NOTE Epoxide resin grouts are more expensive and some might take longer to apply and clean off than cement based grouts.